

WHAT IS CLAIMED IS:

1. A method of manufacturing a semiconductor device, comprising the steps of:

5 selectively introducing a metal element for accelerating crystallization into an amorphous silicon film, and
 irradiating the silicon film with laser light or strong light.

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2. The method according to claim 1, wherein the metal element is one or a plurality of elements selected from the group consisting of Fe, Co, Ni, Ru, Rh, Pd, Os, Ir, Pt, Cu, Ag and Au.

10 3. The method according to claim 1, wherein the metal element is an interstitial element.

4. The method according to claim 1, wherein a concentration of the metal element in the film is 1×10^{15} atoms cm^{-3} to 5×10^{19} atoms cm^{-3} .

15 5. The method according to claim 1, wherein the irradiating step is performed in a state that the silicon film is heated to 450 to 600°C.

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6. A method of manufacturing a semiconductor device, comprising the steps of:

selectively introducing a metal element for accelerating crystallization into an amorphous silicon film;

20 irradiating the silicon film with laser light or strong light, to produce a crystalline silicon film; and

subjecting the crystalline silicon film to a heat treatment.

7. The method according to claim 6, wherein the metal element is one or a plurality of elements selected from the group consisting of Fe, Co, Ni, Ru, Rh, Pd, Os, Ir, Pt, Cu, Ag and Au.

5 8. The method according to claim 6, wherein the metal element is an interstitial element.

9. The method according to claim 6, wherein a concentration of the metal element in the film is 1×10^{15} atoms cm^{-3} to 5×10^{19} atoms cm^{-3} .

10. The method according to claim 6, wherein the irradiating step is performed in a state that the silicon film is heated to 450 to 600°C.

11. A manufacturing method of a semiconductor device, comprising the steps of:

15 in a state that a catalyst element for accelerating crystallization of an amorphous silicon film or a compound thereof is held in contact with the amorphous silicon film,

imparting crystallinity to the amorphous silicon film by irradiating it with laser light or strong light; and

subjecting a crystallinity-imparted silicon film to a heat treatment.

20 12. The method according to claim 11, wherein the catalyst element is one or a plurality of elements selected from the group consisting of Fe, Co, Ni, Ru, Rh, Pd, Os, Ir, Pt, Cu, Ag and Au.

13. The method according to claim 11, wherein the catalyst element is an interstitial element.

14. A manufacturing method of a semiconductor device, comprising the steps of:

5 applying, to an amorphous silicon film, a solution in which a catalyst element for accelerating crystallization of the amorphous silicon film is dissolved or dispersed; and

improving crystallinity of the silicon film by irradiating it with laser light or strong light.

10 15. The method according to claim 14, wherein the catalyst element is one or a plurality of elements selected from the group consisting of Fe, Co, Ni, Ru, Rh, Pd, Os, Ir, Pt, Cu, Ag and Au.

16. The method according to claim 14, wherein the catalyst element is an interstitial element.

15 17. A manufacturing method of a semiconductor device, comprising the steps of:

20 applying, to an amorphous silicon film, a polar solvent in which a compound of a catalyst element for accelerating crystallization of the amorphous silicon film is dissolved or dispersed;

imparting crystallinity to the silicon film by irradiating it with laser light or strong light; and

subjecting a crystallinity-imparted silicon film to a heat treatment.

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18. The method according to claim 17, wherein the solution includes one or a plurality of polar solvents selected from the group consisting of water, alcohol, acid and ammonia water.

19. The manufacturing method according to claim 17, wherein the catalyst element is nickel in the form of a nickel compound.

20. The manufacturing method according to claim 19, wherein the nickel compound is at least one compound selected from the group consisting of nickel bromide, nickel acetate, nickel oxalate, nickel carbonate, nickel chloride, nickel iodide, nickel nitrate, nickel sulfate, nickel formate, nickel acetylacetone, nickel 4-cyclohexylbutyrate, nickel oxide, and nickel hydroxide.

21. A method of manufacturing a semiconductor device, comprising the steps of:

the first step of introducing a metal element for accelerating crystallization into an amorphous silicon film;

the second step of irradiating the amorphous silicon film with laser light or strong light;

the third step of subjecting the silicon film to a heat treatment; and repeating the second and third steps two or more times in total.

22. A method of manufacturing a plurality of thin-film transistors on a substrate having an insulative surface, comprising the steps of:

forming an amorphous silicon film on the substrate having the

insulative surface;

selectively introducing a metal element for accelerating crystallization of silicon into the amorphous silicon film so that the metal element is brought in contact with a surface of the amorphous silicon film; and

imparting crystallinity to the amorphous silicon film by irradiating it with laser light.

ADD
D⁷

add
F¹

add
H²

add
G⁸

add
K¹¹

add
L⁷

add
M¹¹